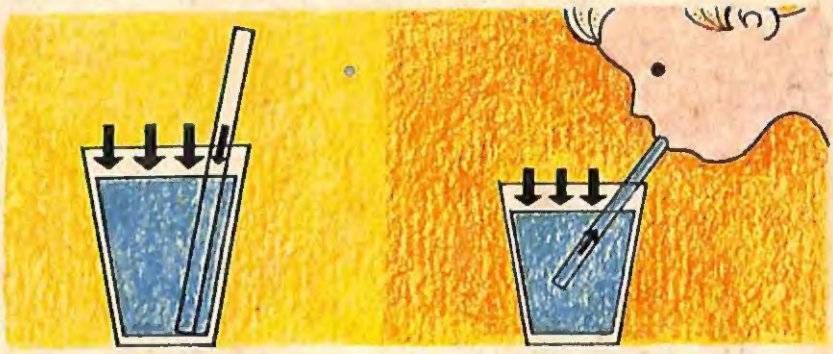
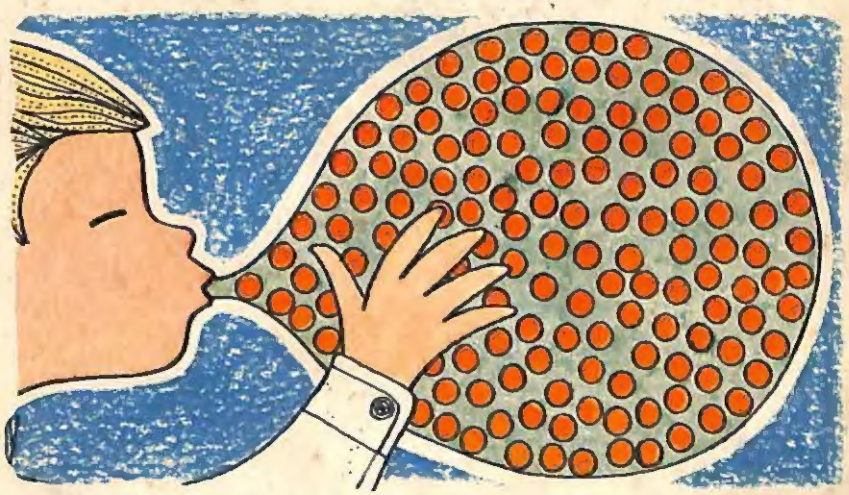
Air





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Air

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Air is all around us, everywhere.

We look right through air all the time and never see it. Air is something that we cannot see, cannot smell, cannot taste.

Yet air is everywhere. We even find air in soil and in water. We find it in everything that has a hole or space in it.

...V.B. MEHARI
Date 16.8.05
Acc. No. 11792

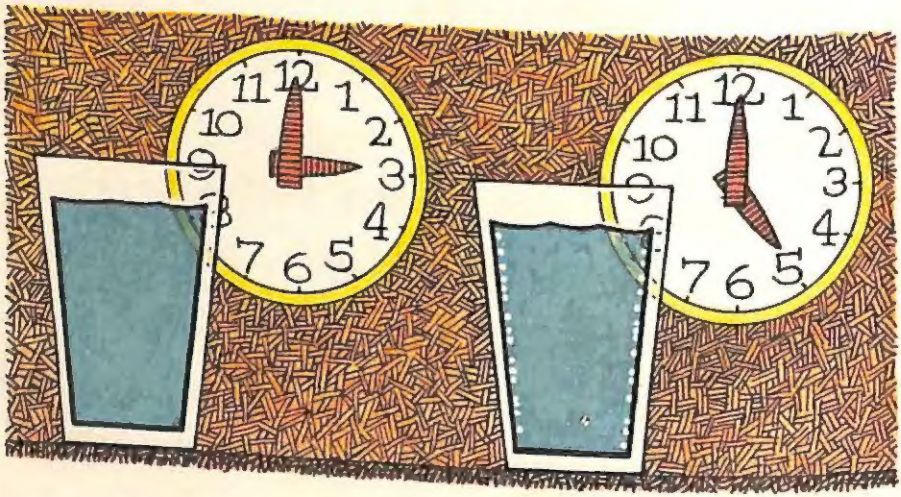
Fill a glass half full of soil. Then pour water into the glass until the water has covered the soil. You will see bubbles of air coming out of the soil. The air was between the bits of soil.

Put a sponge or a building brick into a pail of water. Bubbles of air will come out of the sponge and the brick. The sponge and the brick have holes or space in them. These holes are filled with air.

To show that there is air in water, fill a glass with cold water. Then look at the water. There does not seem to be any air in it, does there?

Let the glass of water stand in a warm place for a few hours. Now look at the glass again. You will see tiny bubbles of air on the sides of the glass.

The air was inside the water. When the water became warmer, some of the air came out of the water.

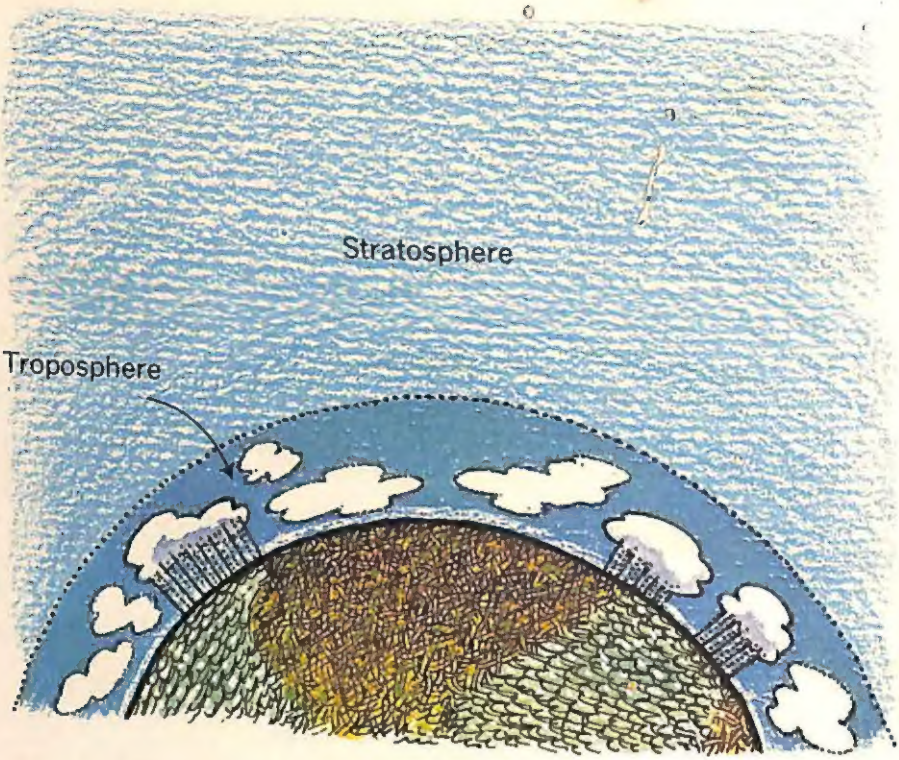


We live at the bottom of an ocean of air. This ocean of air covers the earth. We call it the atmosphere.

The atmosphere reaches far out into space, but it gets rapidly thinner as we go up.

The lowest layer of air is the one we live in. This layer is called the troposphere. It is between five and ten miles high.

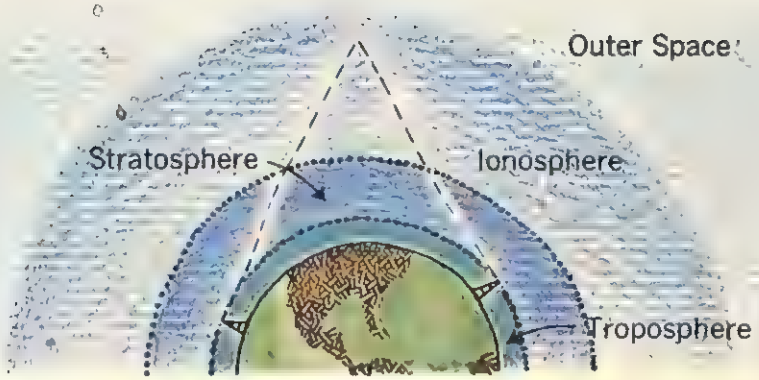
In this layer are clouds, wind, rain, snow, and everything that makes up the weather.



The layer of air above the troposphere is called the stratosphere. It is about fifty miles high. The air in the stratosphere is very thin indeed.

There is no weather in the stratosphere. There are no clouds, wind, rain or snow.

Jet planes fly in the stratosphere.



Above the stratosphere there is a third layer of air, called the ionosphere. It reaches up to about 500 miles above the earth.

The air is exceedingly thin in the ionosphere. Here the particles of air are found in a special form, called ions.

These ions are very useful to man. Radio waves bounce off them and come back to earth. This helps us to send radio waves all over the world.

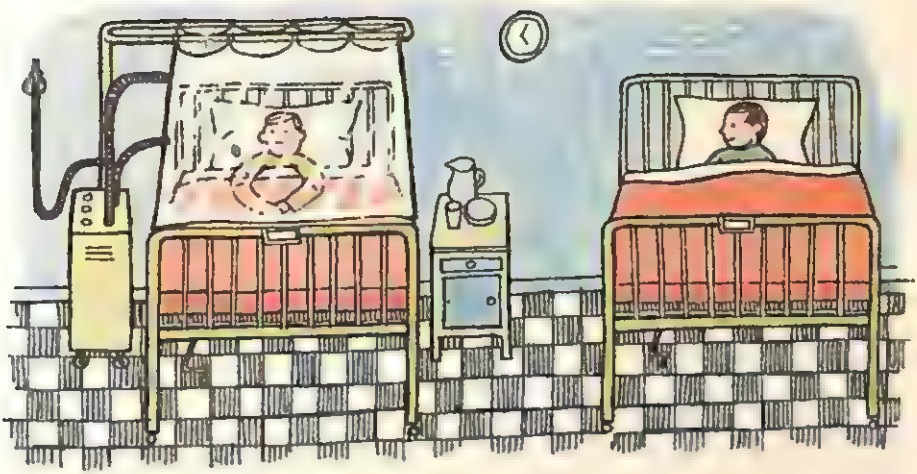
We do not know exactly where the ionosphere merges into the vast regions of outer space.

Air is made up of many gases, all mixed together.

One of these gases is called oxygen. Oxygen is very important to us.

We need oxygen to breathe. Without oxygen we cannot live. The food we eat uses oxygen which gives us energy.

Animals and plants need oxygen, too.

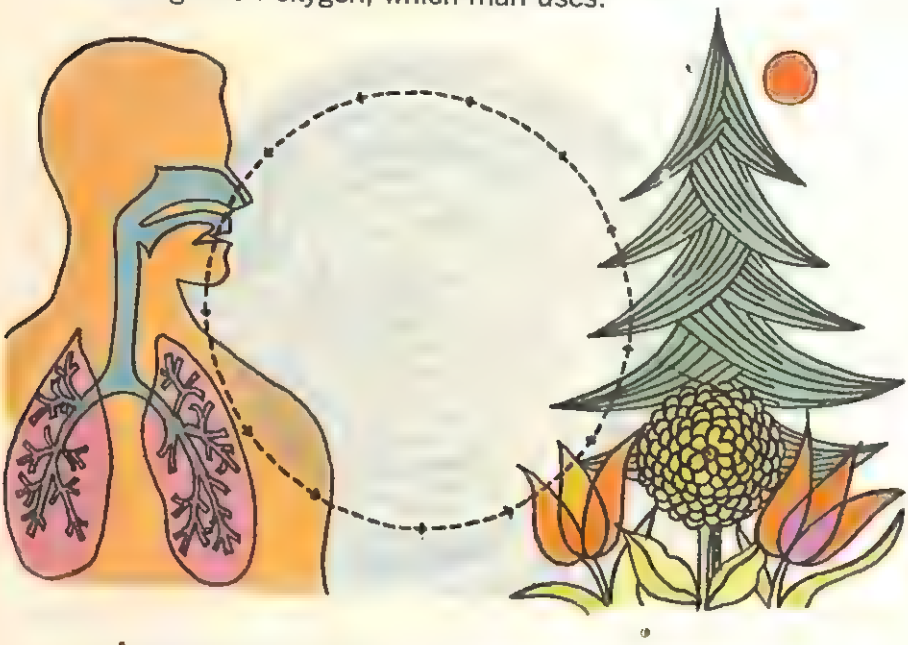


Sometimes, when people are very ill, the doctor gives them pure oxygen to breathe. The sick person lies under a cover called an oxygen tent.

Many kinds of engines use the oxygen in the air to burn the fuel that makes them run. They get the oxygen by mixing the air with the fuel.

When coal, wood or oil is burning in a furnace, the fire needs the oxygen in the air to keep burning.

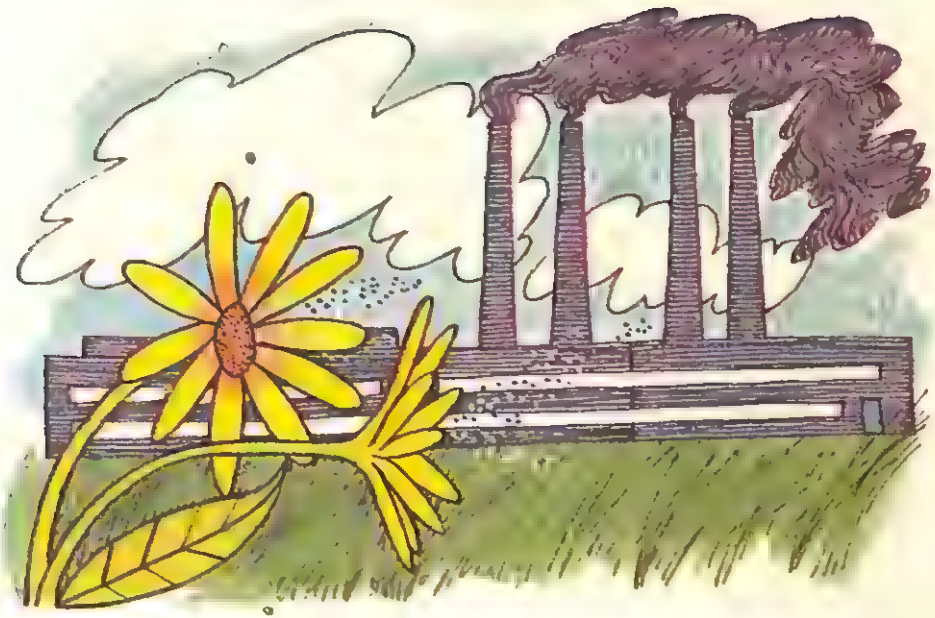
Man breathes out carbon dioxide, which plants use.
Plants give off oxygen, which man uses.



Another gas in the air is called nitrogen. Together nitrogen and oxygen make up most of the air around us.

Still another gas in the air is carbon dioxide. We breathe out this gas. Plants need this gas to make food and grow.

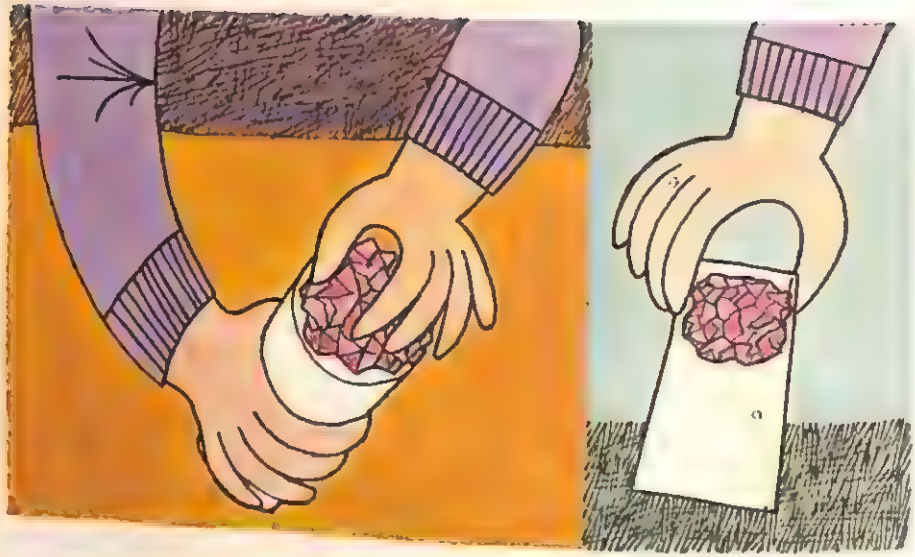
Water is in the air, too, in the form of a gas. When water is a gas, it is called water vapour.



Many things besides water leave the earth and go off into the air.

Factories give off smoke, soot and gases. All these go off into the air. Some of the soot settles on our houses. Some of the gases in towns have an unpleasant smell. We like fresh air better.

The air has lots of dust from the earth in it. It has pollen from plants, too.



If we cannot see, smell or taste fresh air, how do we know that it is real?

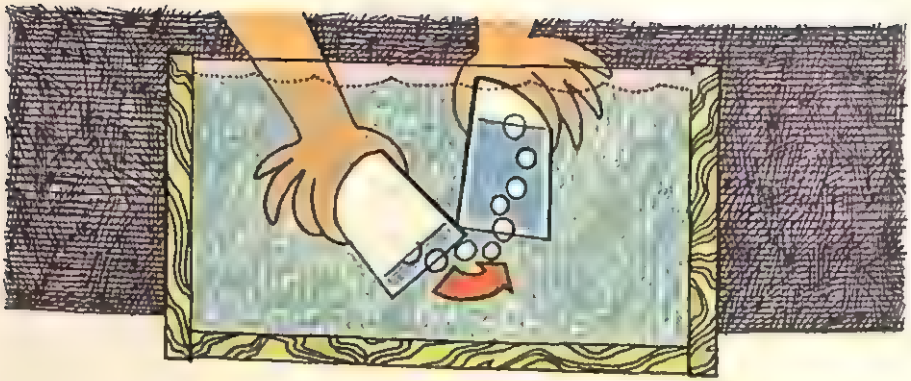
Anything that is real will take up space and have weight. If we can show that air takes up space and has weight, then we shall know that air is real.

Crumple up a paper napkin, and push it down to the bottom of a glass. Make sure that the napkin cannot fall out when the glass is turned upside down.

Now turn the glass upside down. Push it straight down into a bowl of water. The water will not rush into the glass. The air inside the glass is taking up space. The water cannot get far into the glass.

Now take the glass out of the water. Pull out the napkin. The napkin will be dry. The air pushed against the water and did not let the water rise far into the glass.

The air takes up space.



Push a glass into the water on its side, so that it fills up with water. Push another glass upside down straight down into the water, so that it is filled with air.

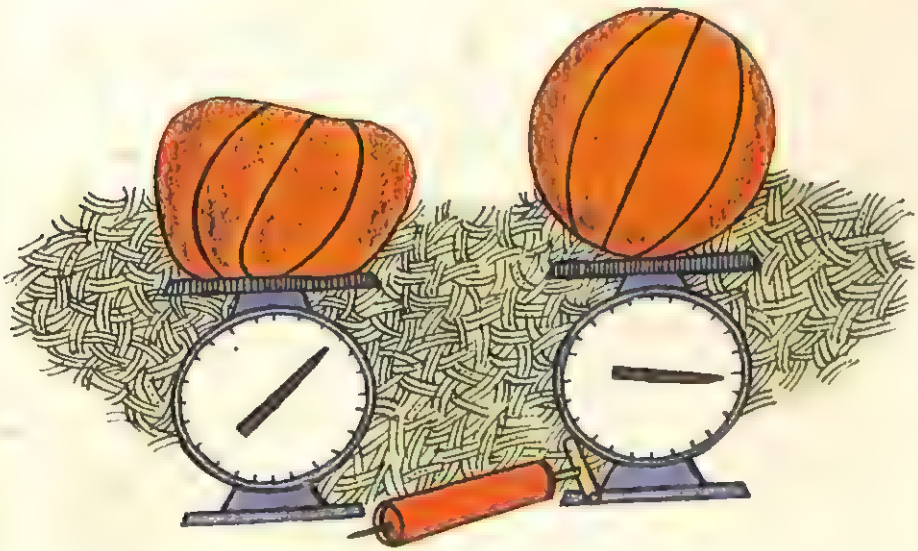
Bring the glass full of air close to the glass full of water, so that the two rims touch and both glasses are bottoms up.

Slowly turn the glass of air sideways, just under the glass of water. Bubbles of air will leave the glass that looked empty. These air bubbles take up space and push the water out of the other glass. So when you see the bubbles in the water, you can see air.

Air not only takes up space, but it also has weight. To show that air has weight, get a football and let all the air out of it. Weigh the empty football on some scales.

Now pump air into the football until the ball is hard and round. Weigh the ball again. Now it will weigh more. It weighs more because there is air inside it.

So air is real, because it takes up space and has weight.



Air presses in all directions.

We know that air exists because it presses or pushes against other things. The wind presses on us, but even still air has pressure. It presses against the surface of our bodies. It presses against the surface of the earth.

About fifteen pounds of air press against a piece of the earth that is one inch long and one inch wide. We say that the air pressure on earth is about fifteen pounds on each square inch.

Air presses in all directions—downwards, upwards and sideways.

You can show that air has pressure.

Fill a glass to the very top with water. Hold it over the sink, and put a piece of thin cardboard on top. Press the flat of your hand hard against the cardboard. Then gently turn the glass upside down.

Now take your hand slowly and carefully away from the cardboard. The water will not run out of the glass.

The water pushes against the cardboard and tries to run out. But the air presses harder on the other side of the cardboard. Air pressure does not let the water run out.

Air pressure can do work. It helps you to drink milk, water or any other liquid through a straw.

When a straw is in a liquid like lemonade, the pressure of the air on the lemonade inside the straw is the same as the pressure of the air on the lemonade outside the straw.

When you suck air from the straw up into your mouth, there is less air in the straw. This air now has less pressure on the lemonade inside the straw. The pressure of the air on the lemonade outside the straw then makes the lemonade move up inside the straw.

Air pressure works when you use a medicine dropper. Put the open end of the dropper into a glass of water. When you squeeze the rubber bulb of the dropper you make some of the air go out of the dropper. When you stop squeezing, water runs up into the dropper.

The air is pressing down all over the surface of the water. The air pressure makes the water move up inside the dropper.

Now when you squeeze the bulb, you can let the water out one drop at a time. This is because air is inside the bulb. When you squeeze the bulb, the air inside pushes the water out.

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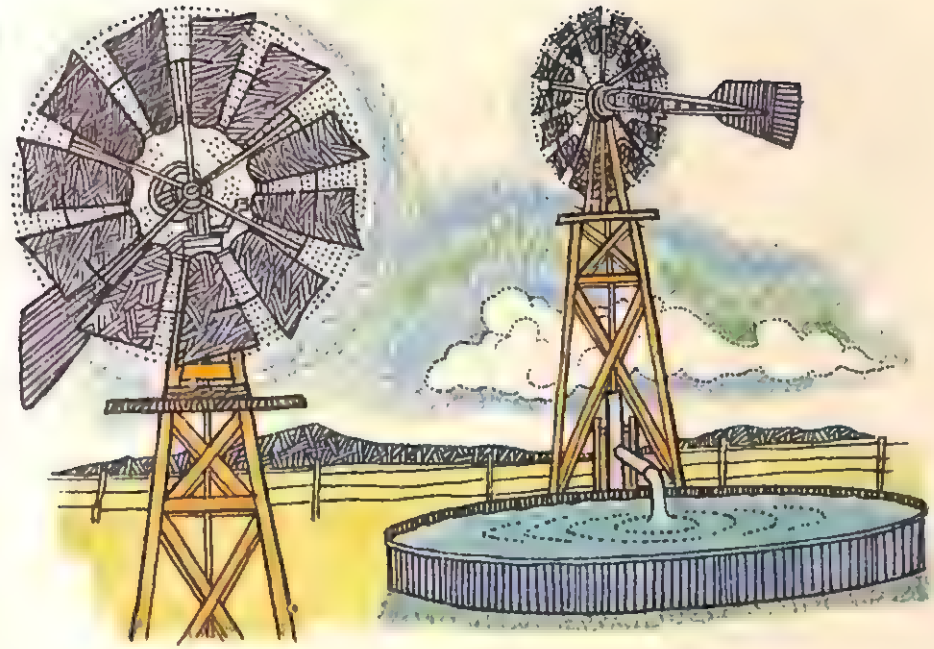
Wind is air that moves fast. You can feel the wind when you run. If you run into the wind, it pushes and makes you run more slowly. When the wind blows on your back, it pushes with you and helps you run faster.

A kite flies because the wind pushes at it, lifts it up, and then pushes it along.

A sailing boat moves when the wind pushes against the sail.

Wind makes pinwheels turn. You can make the wind by blowing on a pinwheel.

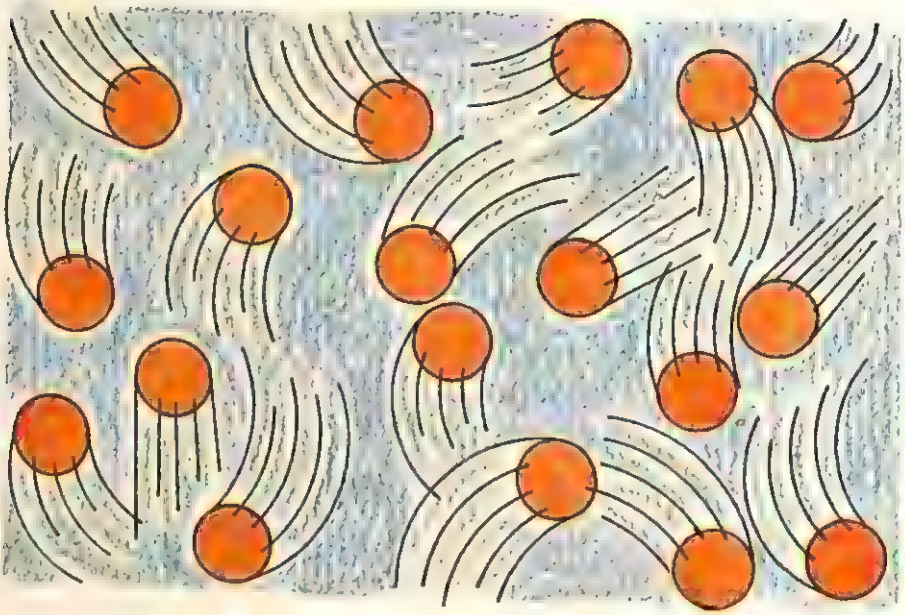


Wind makes windmills turn. The wind blows against the wheel at the top of the windmill. The wheel is joined to machinery.

When the wind blows, the wheel starts to turn. The turning of the wheel makes the machinery start moving.

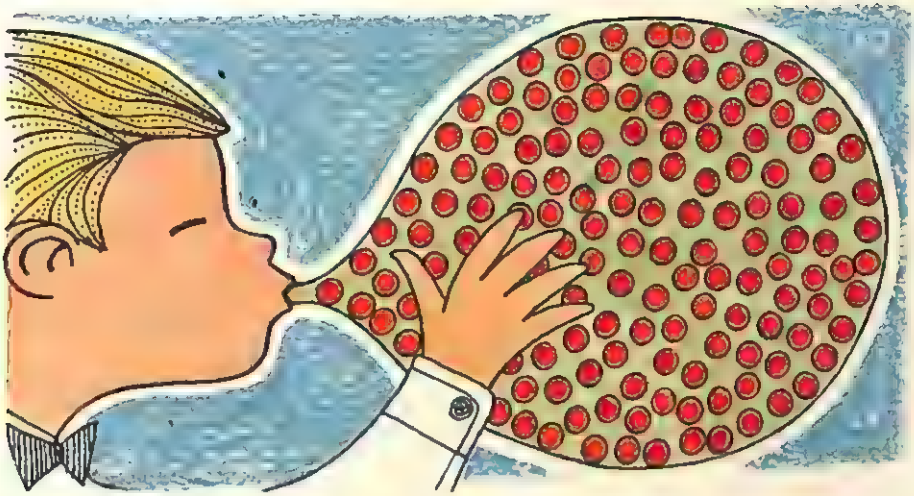
A windmill may be used to pump water or to grind corn or to make electricity.

Molecules are always moving.



All the gases in the air are made up of tiny bits, or particles, called molecules. These molecules are so tiny that we cannot see them. They are always moving.

There are spaces between the molecules. In a gas, like air, there is much space between them. Because of these spaces, the molecules can be pressed close together or spread farther apart very easily.

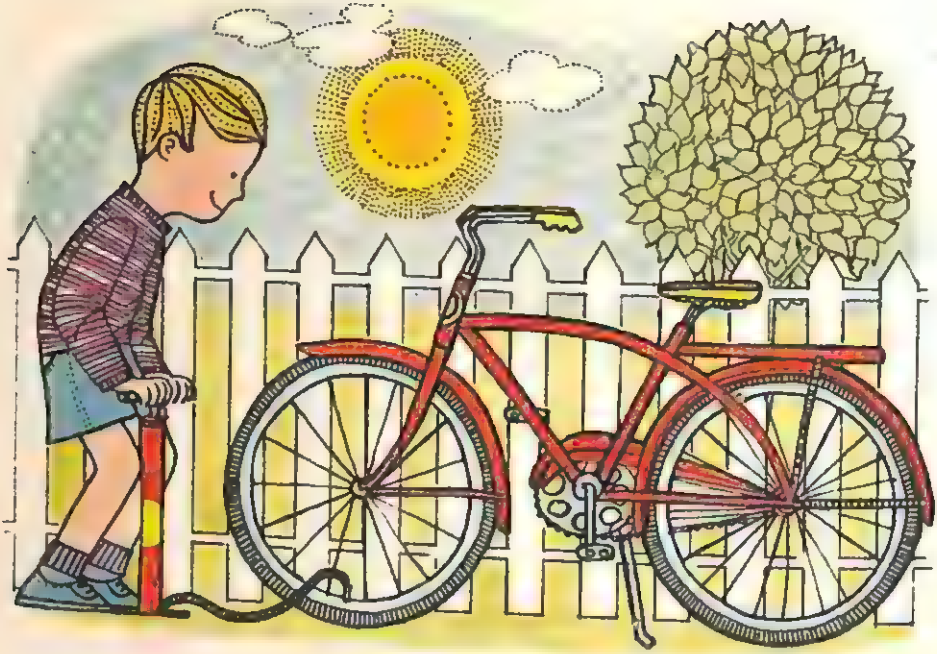


What happens when you blow air into a rubber balloon?

The more air you blow inside, the bigger the balloon gets. The rubber stretches. You must hold the mouth of the balloon closed, or the air will shoot out.

Inside, millions and millions of molecules of air are pressing against the rubber. The air molecules are pressed closer together. We say that the air has been compressed.

We can make compressed air do work.

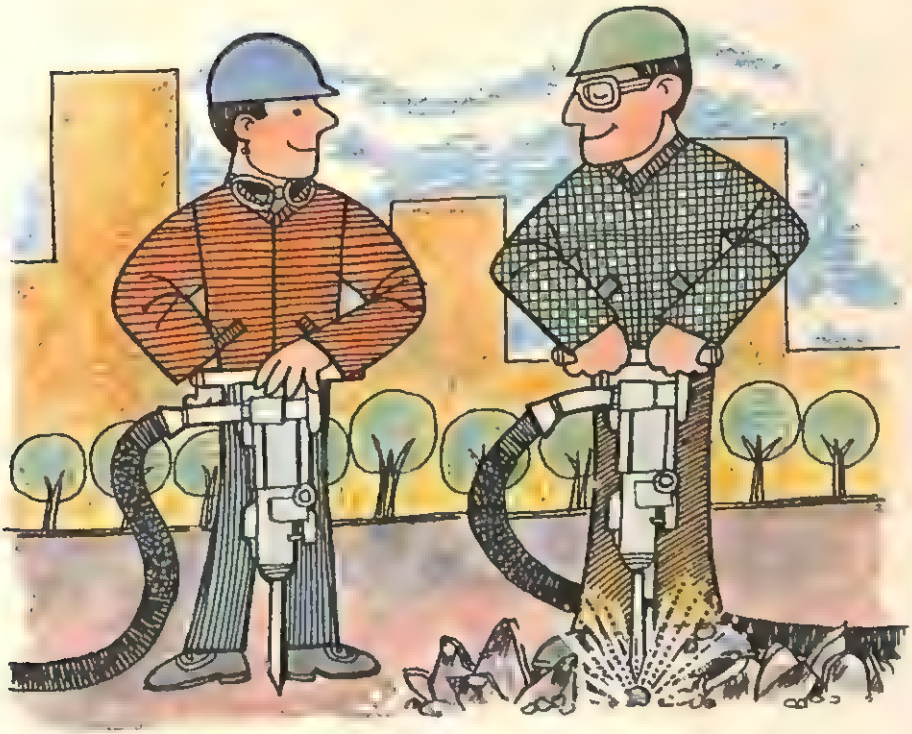


A bicycle pump will compress air in your bicycle tyres. This compressed air can hold up a heavy weight. It can hold up the whole weight of your body. If you had no compressed air in your bicycle tyres, you would have a very bumpy ride.

Compressed air is in the tyres of cars, buses, lorries, tractors and aeroplanes.

A pneumatic drill is a machine that is used to break up rock, cement and concrete.

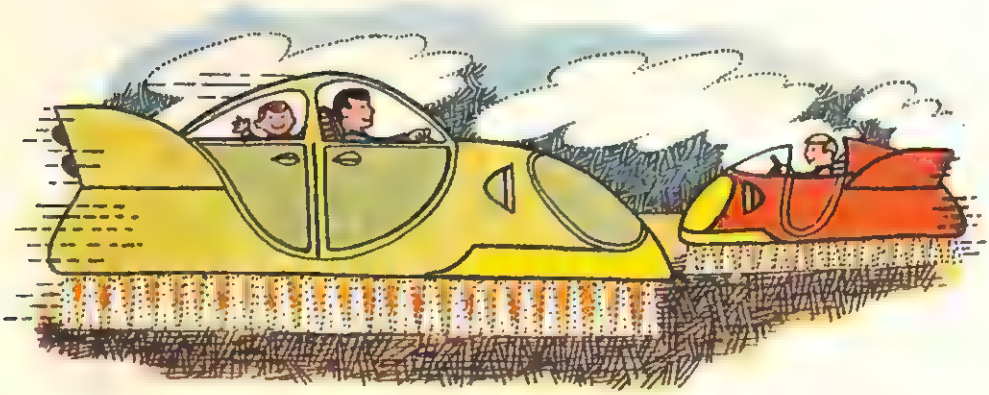
Inside the pneumatic drill there is a piston. Compressed air makes the piston move up and down. The piston drives the point of the drill into the rock or cement and breaks it up into small pieces.



Compressed air can be used to stop buses, lorries and trains. When a lorry driver steps on the brake pedal, compressed air inside a tank makes the brakes stop the lorry.

Some day we may use cars that have no wheels, but move along on compressed air instead. Cars like this are being tested.

The compressed air shoots down from the car and lifts it a few inches off the ground. Then the car moves along over this blanket of compressed air.



Air helps us in many other ways.

Air helps sound to travel, so that we can hear things. Air helps to pump water out of a well. Air works for us when we use a siphon to get water out of an aquarium.

Air helps to make a vacuum cleaner work. We use air conditioning on hot summer days.

Air helps aeroplanes to fly. Air also helps parachutes to come down slowly to earth.

Air works for us in many ways, but the most important thing about air is that people and animals cannot live without it.

Things you can do

Show that air has oxygen in it. Get a medicine bottle or a narrow glass jar. Push a wad of steel wool all the way down to the bottom of the bottle. Pour some water into the bottle, shake well until the steel wool is very wet, then pour off all the water. Get a soup plate and add water to the plate until the water is about an inch deep. Now put the bottle mouth down into the plate and let the bottle stand like this for a whole day and night.

Water will rise up the bottle. See how rusty the steel wool has become. The steel combines with the oxygen in the air inside the bottle to form rust (iron oxide). The water then rises up to take the place of the oxygen in the air that was used up. The air that is left behind is mostly nitrogen gas.

Do this experiment to prove that air has carbon dioxide in it. Get some lime water from the chemist's shop. Put some of the lime water into a small clear glass bowl. Leave the bowl out in the fresh air for a few hours. Whenever carbon dioxide gas meets lime water, the lime water will become milky. Because there is carbon dioxide in the air, the lime water in the glass bowl becomes milky.

Show that air has water vapour in it. Get a tin can that has had its top taken off smoothly so that it will not cut you. Tear away the paper label and scrub the sides of the tin with soap and water until the sides are bright. Dry the outside of the tin and then half fill it with ice cubes from the refrigerator. Soon droplets of water will appear on the sides of the tin. When the warm air meets the cold sides of the tin, some of the water vapour in the air changes into droplets of water.

Show that air has dust in it. Cut out a piece of white paper so that it just fits the bottom of a deep cake tin. Place the paper in the cake tin, then put a stone on the paper to keep the paper down. Now put the tin outside on the windowsill so that the fresh air can

get at it. After a day or two, see how much dust has collected from the air on the paper.

Find out about smoke and soot in the air. When air has a lot of smoke, soot and harmful gases in it, we say that the air is polluted. Find out the different ways that the air is being polluted in the city or town where you live. Try to learn what your city or town is doing to cut down or stop the pollution of the air.

Learn more about radio and the ionosphere. Turn on the radio at night and see how much easier it is to tune in far-away radio stations in the night-time than in the day-time. This happens because the sun affects the thickness of the ionosphere layer. When the sun is shining, the layer of the ionosphere becomes thinner, so the radio waves pass through the ionosphere instead of bouncing back to earth. At night the layer of the ionosphere becomes much thicker, so the radio waves do bounce back to earth and we hear far-away radio stations very clearly.

Show that heating and cooling affect air pressure. Snap a small balloon over the mouth of a dry medicine bottle, and stand the bottle in a saucepan of cold water. Slowly heat the saucepan on the stove until the water is hot. Watch the balloon. What do you see? The air inside the bottle becomes warmer and spreads out. As the air spreads out, it pushes into the balloon and against the sides of the balloon. The balloon begins to blow up because the warmed air inside the balloon now has more pressure.

Then let the water in the saucepan cool down. The air inside the bottle also cools. What happens to the balloon?

Make the air move faster. Fan yourself with a piece of cardboard and feel the "wind" as the air moves across your face. An electric fan makes the air move more quickly, so you get an even stronger "wind".

Show that air pressure can lift a book. Put a paper bag on the table and let the mouth of the bag hang over the edge of the

table. Put a book on top of the closed end of the bag. Now hold the open end of the paper bag against your mouth and blow hard. The pressure of the air coming from your lungs will lift the book.

Words younger children may need help with

(Numbers refer to page on which the word first appears)

5 sponge
7 atmosphere
layer
troposphere
8 stratosphere
9 ionosphere
particles
ions
radio
10 oxygen
breathe
energy
11 pure
engines
fuel
furnace
12 nitrogen
carbon dioxide
vapour
13 factories
pollen
14 weight
crumple
napkin
16 sideways
17 football
18 pressure
surface
square
19 cardboard
carefully
20 liquid
21 medicine
squeeze
rubber
bulb
22 kite
sailing boat
pinwheel
23 windmill
machinery
grind
electricity
24 molecules
25 stretches
millions
compressed
26 bicycle
tractors
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drill
cement
concrete
piston
28 pedal
tank
tested
blanket
29 siphon
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7 **Rocks and Minerals** Lou Williams Page

8 **Sound** Charles D. Neal

9 **Air** Edna Mitchell Preston

10 **Frogs and Toads**
Charles A. Schoenknecht

11 **Mammals** Esther K. Meeks

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